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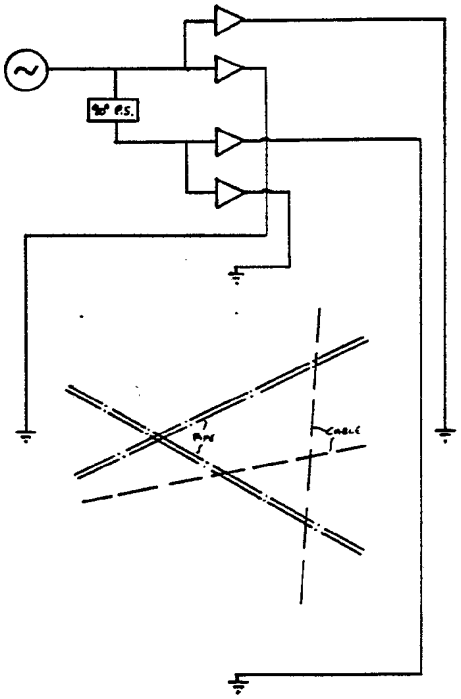
(54) Method and apparatus for the location of underground pipes and cables

(57) Underground metallic objects, such as pipes and cables are detected by generating a rotating current in the area under investigation and using a coil detector to detect the resultant electromagnetic fields generated in the underground objects. In order to obtain the rotating current two orthogonal pairs of metal stakes may be inserted in the ground around the area to which 90° phase shifted signals are alternately applied from an A.C. source.



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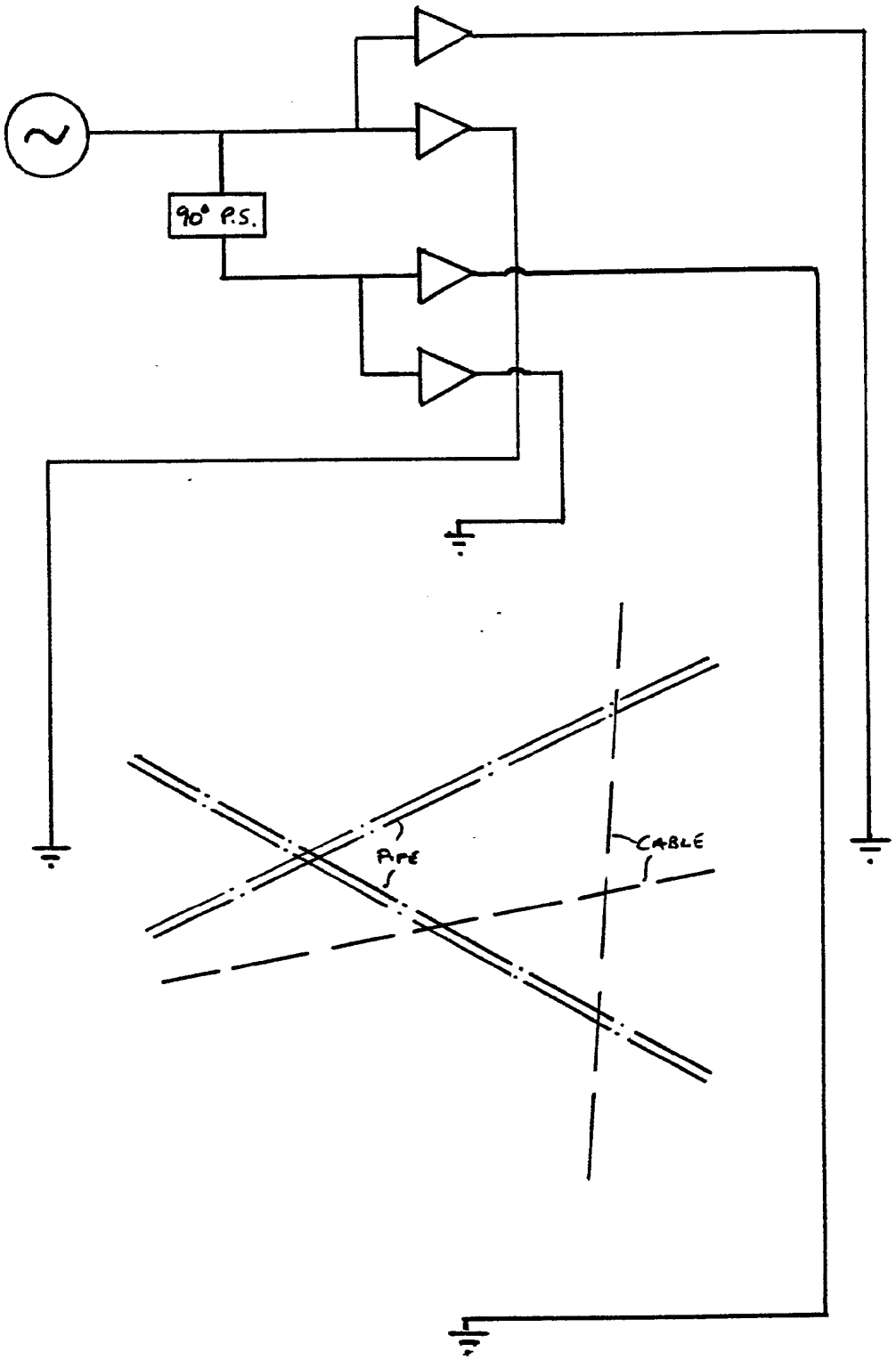

"Improvements relating to Underground Pipe and Cable Location"

A basic problem in pipe and cable avoidance is to verify that a limited area is clear of such services, for example to allow excavation or augering to be carried out. Electromagnetic techniques enable buried metallic structures to be located by detecting the fields produced by currents flowing in them. Considerable confidence in the safety of such an excavator can be obtained by so called passive location, that is, by monitoring currents originating from electric power distribution or low frequency radio transmissions.

But to be certain that an area contains no metallic services, in particular short cable runs or small diameter cables, a distinctive signal normally has to be introduced onto the conductor from a transmitter on the ground. The usual practice is to use a low frequency induction loop producing a solenoidal field. The disadvantage is that a conductor parallel to the axis of this loop does not have a current induced in it and therefore is not detected. The operator has to sweep the area by repeatedly moving the receiver over or around the proposed excavation with the transmitter at different points.

It is the aim of this invention to provide a solution to this problem.

According to one aspect of the present invention there is provided a method of detecting underground metallic objects, such as pipes and cables, comprising generating a rotating current within an area of the ground to be investigated and using coil sensing means and associated indicator means to detect electromagnetic fields generated by such currents in underground objects.

The rotating current may be created by generating out-of-phase alternating voltages and applying them to the ground over the area to be investigated.

Conveniently, a single alternating voltage generator will have its output divided, one branch signal being phase shifted by 90° with respect to the base voltage. Each branch may then be subdivided, the current passed into the ground by pairs of metal stakes around the area to be investigated, those with the base frequency alternating with those with the phase shifted frequency, thereby creating the rotating ground current. Such a current naturally concentrates in any nearby electrically conductive object, such as a metal pipe or cable, which will radiate an alternating field. This can be picked up by known instrumentation.

According to another aspect of the invention

there is provided apparatus for detecting underground metallic objects, such as pipes and cables, comprising means for generating and applying to the ground over an area to be investigated an electrical signal which creates a rotating current within that area, and detection coil means and associated indicator means for detecting the electromagnetic field generated by such currents in underground objects.

CLAIMS

1. A method of detecting underground metallic objects, such as pipes and cables, comprising generating a rotating current within an area of the ground to be investigated and using coil sensing means and associated indicator means to detect electromagnetic fields generated by such currents in underground objects.

2. A method according to Claim 1, wherein said rotating current is generated by applying out-of-phase alternating voltages to the ground over the area to be investigated.

3. A method according to Claim 2, wherein a single alternating voltage generator has its output divided, one branch signal being phase shifted by 90° with respect to the base voltage.

4. A method according to Claim 2, wherein each branch is subdivided and the current passed into the ground by pairs of metal stakes around the area to be investigated, those with the base frequency alternating with those with the phase shifted frequency, thereby creating the rotating ground current.

5. Apparatus for detecting underground metallic objects, such as pipes and cables, comprising means for generating and applying to the ground over an area to be investigated an electrical signal which

creates a rotating current within that area, and detection coil means and associated indicator means for detecting the electromagnetic field generated by such currents in underground objects.

6. Apparatus according to Claim 5, wherein said generating means is operable to generate out-of-phase alternating voltages and includes means for directly applying said voltages to the ground, thereby to create said rotating current.

7. Apparatus according to Claim 6, wherein said generating means is operable to output a first alternating voltage and a second alternating voltage phase shifted by 90°.

8. A method of detecting underground metallic objects substantially as hereinbefore described with reference to the accompanying drawing.

9. Apparatus for detecting underground metallic objects, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawing.

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